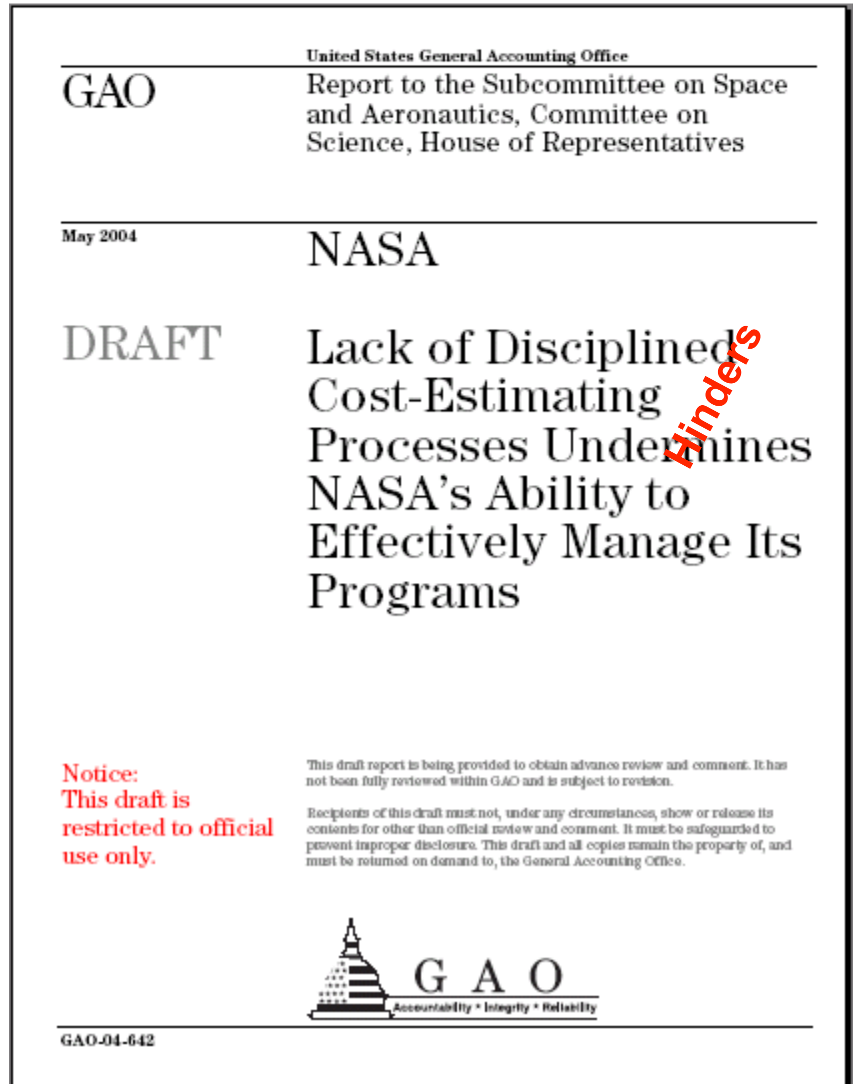
Overview of CADRe

Background

- NASA previously had no current repository of historical project data (programmatic, cost, and technical data)
- Cost risks have not been well documented or not explicitly addressed in most project estimates
- History of projects not recorded so we have difficulty learning from the past
- Quality of cost estimates vary from project to project.
- When cost data are collected, they are not disseminated or made available to others

2004 GAO Report Findings-Genesis for CADRe

- 1992 GAO study of NASA cost analysis
  - 29 projects; median cost growth 77%
- 2004 GAO study
  - 27 projects; median cost growth 13%
- 2004 GAO recommendations
  - Develop an integrated plan including
    - Guidance for rebaselining
    - Enforced use of EVM
    - Staff and support for cost-estimating and EVM
  - Establish standard LCCE framework
    - Include full life cycle
    - Use a standard WBS that encompasses both in-house and contractor efforts
    - Use a Cost Analysis Requirements Description (CARD)
    - Develop Independent Cost Estimates (ICEs) at each milestone
    - Use cost risk assessments
  - Prohibit projects from proceeding through the review and approval process without above


United States General Accounting Office

GAO

Report to the Subcommittee on Space and Aeronautics, Committee on Science, House of Representatives

May 2004

NASA

DRAFT

Lack of Disciplined Cost-Estimating Processes Undermines NASA's Ability to Effectively Manage Its Programs

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G A O
Accountability * Integrity * Reliability

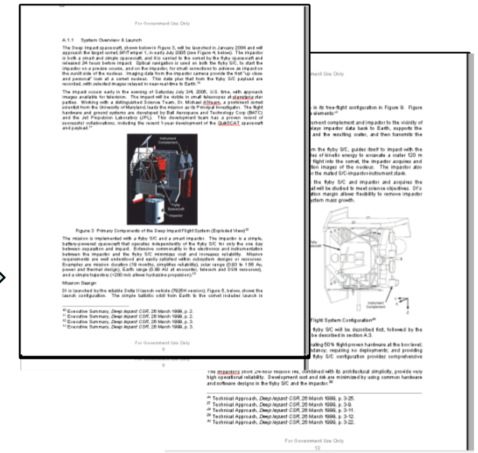
GAO-04-642

CADRe Definition

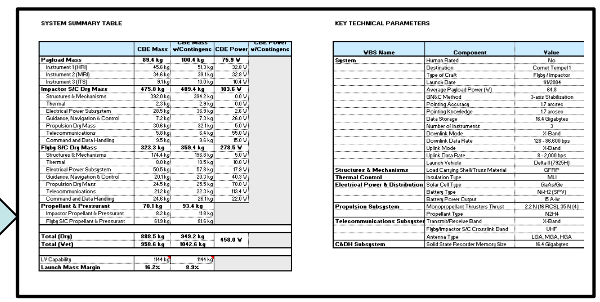
CADRe (Cost Analysis Data Requirement) is a 3 part document that describes a NASA project at each milestone, contains key technical parameters, and captures the estimated and actual costs in a WBS structure. The CADRe provides historical record of cost, schedule, and technical project attributes so that estimators can better estimate future analogous projects.

Parts A, B, C

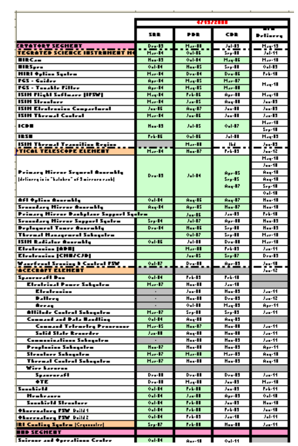
- PART A Describes a NASA project at each milestone (SRR, PDR, CDR Launch and End of Mission), and describes significant changes that have occurred



- PART B Contains standardized templates to capture key technical parameters that are considered to drive cost (Mass, Power, Data Rates)



- PART C Captures the NASA project’s Cost Estimate and actual life cycle costs within the project’s and a NASA Cost Estimating Work Breakdown Structures (WBS)..



- Note: THE “LAUNCH” CADRes for a mission captures the final costs and as-built mass, and power data. The SRR, PDR, CDR CADRes contain Current Best Estimates

Why Are CADRes Needed?

- Provides historical record of cost, schedule, and technical project attributes so that estimators can better estimate future similar projects
- Describes project mission and approach that facilitates understanding
  - Contains objective technical data that tend to drive costs
- Required by NPR 7120.5

Part A Example

Provides Descriptive Info of S/C and Payloads, etc

System Overview

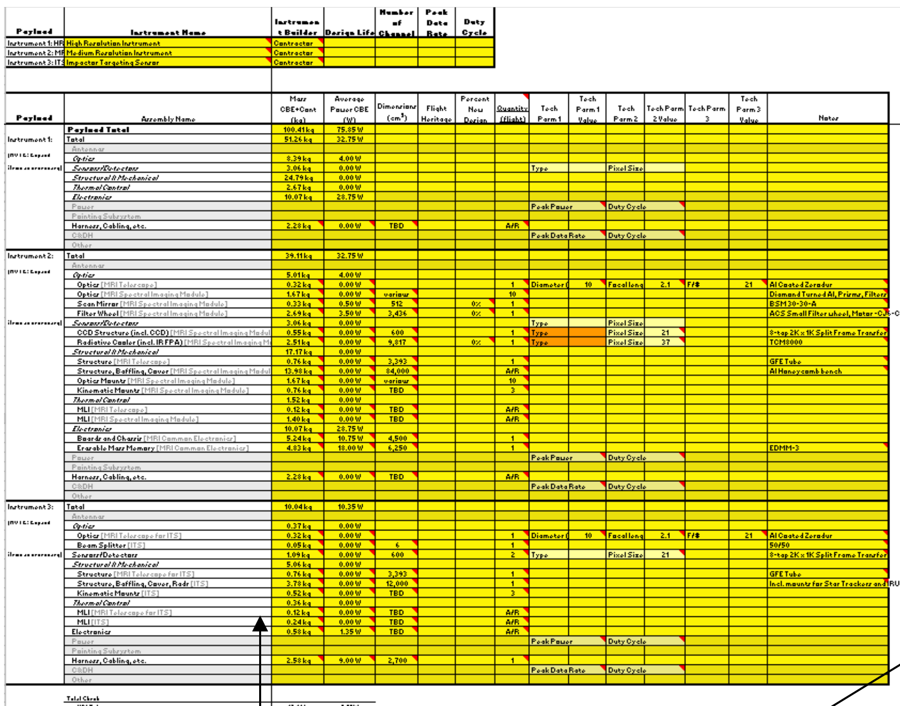
Subsystem Description

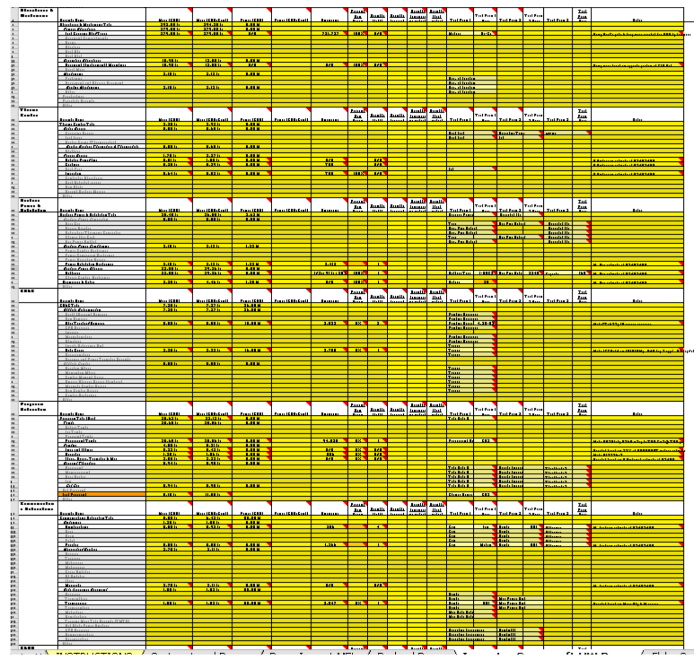
Payload Description

Project Management

Part B Example

Shows the Technical Data (Mass, Power)





System Level Tables

Payload Level Tables

Summary Tables

SYSTEM SUMMARY TABLE

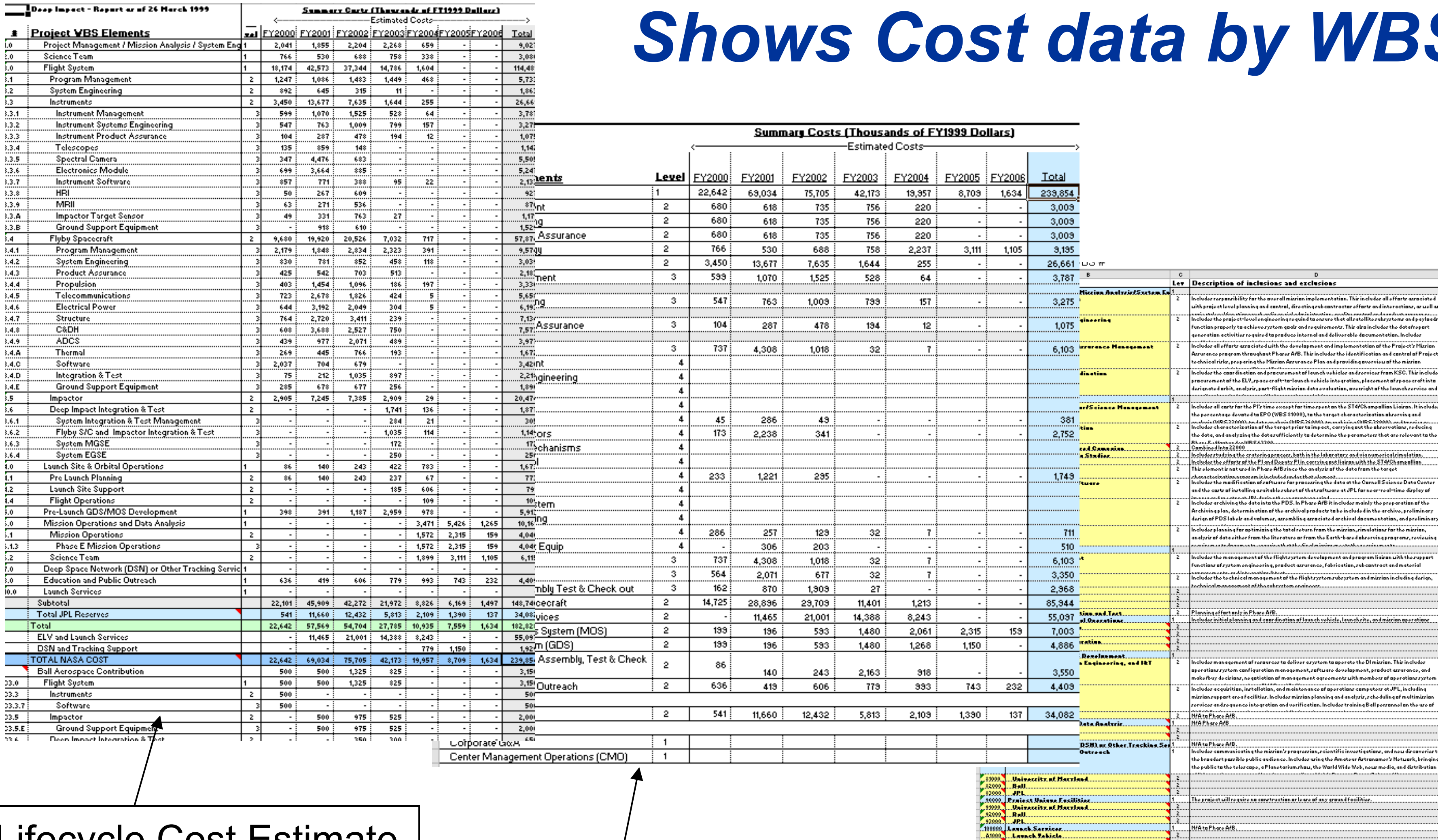
	CBE Mass	CBE Mass w/Contingenc	CBE Power	CBE Power w/Contingenc
Payload Mass	**89.4 kg**	**100.4 kg**	**75.9 W**	
Instrument 1 (HRI)	45.6 kg	51.3 kg	32.8 W	
Instrument 2 (MRI)	34.6 kg	39.1 kg	32.8 W	
Instrument 3 (ITS)	9.1 kg	10.0 kg	10.4 W	
Impactor S/C Dry Mass	**475.8 kg**	**489.4 kg**	**103.6 W**	
Structures & Mechanisms	392.0 kg	394.2 kg	0.0 W	
Thermal	2.3 kg	2.9 kg	0.0 W	
Electrical Power Subsystem	28.5 kg	36.9 kg	2.6 W	
Guidance, Navigation & Control	7.2 kg	7.3 kg	26.0 W	
Propulsion Dry Mass	30.6 kg	32.1 kg	5.0 W	
Telecommunications	5.8 kg	6.4 kg	55.0 W	
Command and Data Handling	9.5 kg	9.6 kg	15.0 W	
Flyby S/C Dry Mass	**323.3 kg**	**359.4 kg**	**278.5 W**	
Structures & Mechanisms	174.4 kg	196.8 kg	5.0 W	
Thermal	8.0 kg	10.5 kg	10.0 W	
Electrical Power Subsystem	50.5 kg	57.8 kg	17.9 W	
Guidance, Navigation & Control	20.1 kg	20.3 kg	40.3 W	
Propulsion Dry Mass	24.5 kg	25.5 kg	70.0 W	
Telecommunications	21.2 kg	22.3 kg	113.4 W	
Command and Data Handling	24.6 kg	26.1 kg	22.0 W	
Propellant & Pressurant	**70.1 kg**	**93.4 kg**		
Impactor Propellant & Pressurant	8.2 kg	11.8 kg		
Flyby S/C Propellant & Pressurant	61.9 kg	81.6 kg		
Total (Dry)	**888.5 kg**	**949.2 kg**	**458.0 W**	
Total (Wet)	**958.6 kg**	**1042.6 kg**		
LV Capability	1144 kg	1144 kg		
Launch Mass Margin	**16.2%**	**8.9%**		

KEY TECHNICAL PARAMETERS

WBS Name	Component	Value
System	Human Rated	No
	Destination	Comet Tempel 1
	Type of Craft	Flyby / Impactor
	Launch Date	1/1/2004
	Average Payload Power (W)	64.8
	GN&C Method	3-axis Stabilization
	Pointing Accuracy	1.7 arcsec
	Pointing Knowledge	1.7 arcsec
	Data Storage	16.4 Gigabytes
	Number of Instruments	3
	Downlink Mode	X-Band
	Downlink Data Rate	128 - 86,600 bps
	Uplink Mode	X-Band
	Uplink Data Rate	8 - 2,000 bps
	Launch Vehicle	Delta II (7925H)
Structures & Mechanisms	Load Carrying Shell/Truss Material	GFRP
Thermal Control	Insulation Type	MLI
Electrical Power & Distribution	Solar Cell Type	GaAs/Ge
	Battery Type	Ni-H2 (SPV)
	Battery Power Output	15 A-hr
Propulsion Subsystem	Monopropellant Thrusters Thrust	2.2 N (16 RCS), 35 N (4)
	Propellant Type	N2H4
Telecommunications Subsyster	Transmit/Receive Band	X-Band
	Flyby/Impactor S/C Crosslink Band	UHF
	Antenna Type	LGA, MGA, HGA
C&DH Subsystem	Solid State Recorder Memory Size	16.4 Gigabytes

Part C Example

Shows Cost data by WBS



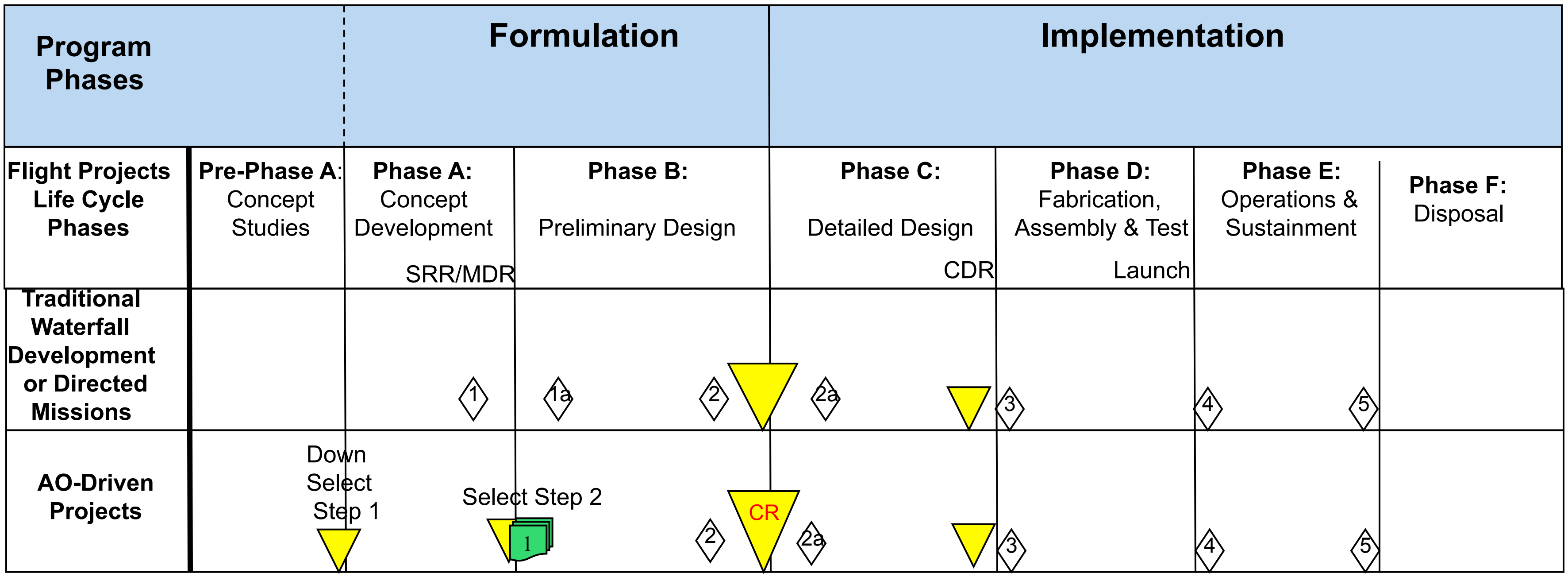
Lifecycle Cost Estimate

Costs Mapped to the NASA WBS

WBS Dictionary

CADRe Timelines

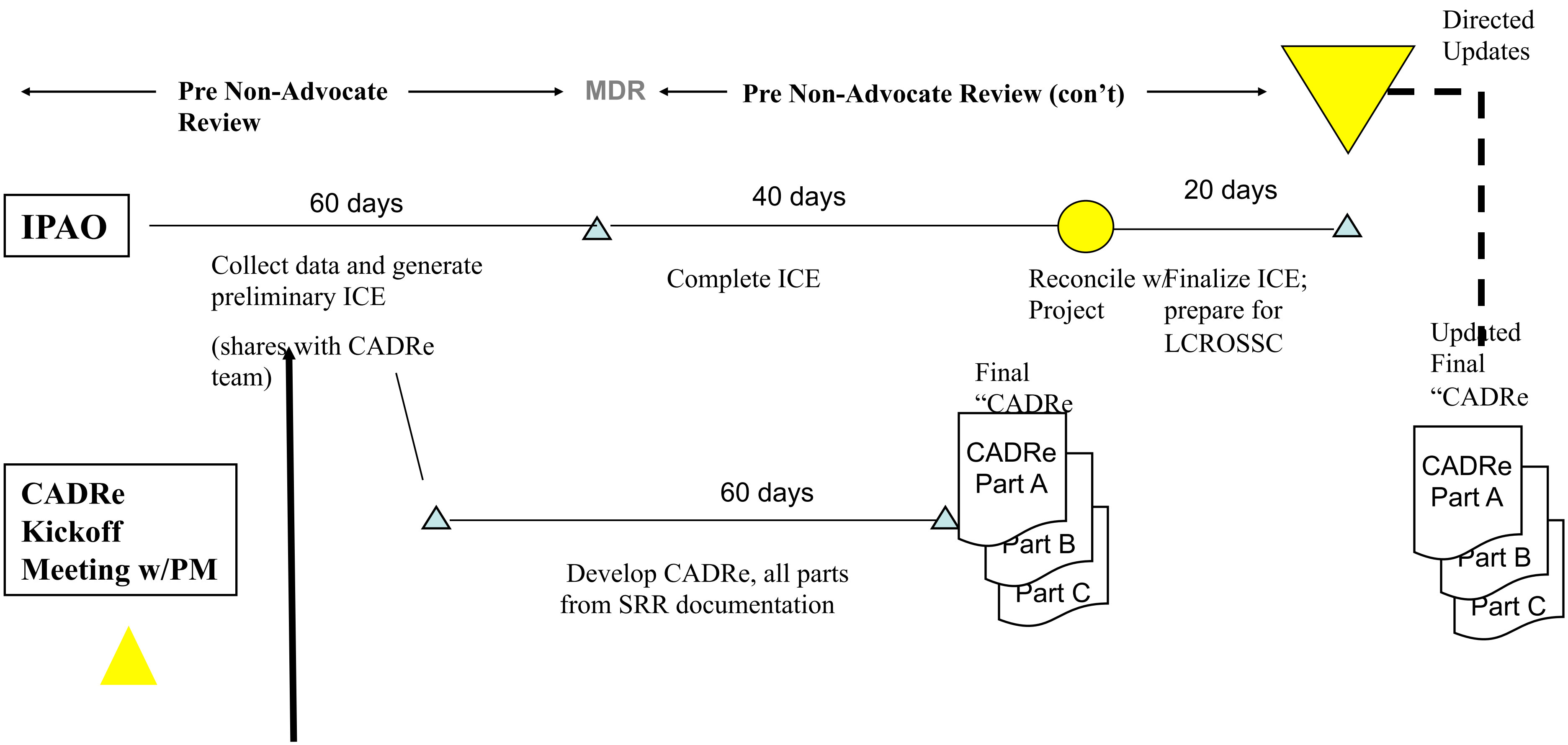
When are CADRes Required?



Legend

- Mission Decision Review/ICR
- 1 — All parts of CADRe due 30 days after site review
- 1a — CADRe update, if necessary
- 1 — CADRe delivered; based on Concept Study Report (CSR) and winning proposal
- 2 — All parts of CADRe due 30 days after site review
- 2a — CADRe update, if necessary
- 3 — Update as necessary 30 days after CDR
- 4 — CADRe, All Parts 90 days after launch, as built or as deployed configuration
- 5 — CADRe, Part C only during last year of planned project life

Timeline for 1st CADRe



Data Sources: Project Plan, Acquisition Strategy, Formulation Approval Document (FAD), Systems Engineering Management Plan (SEMP), SRR documentation, Master Equipment Lists (MELS), & Project Plan

*IPAO agrees to place collected data on PBMA

Source Documents for CADRe

Part A. Descriptive Information
-Project Plan
-Architecture Description Document
-Acquisition Plan
-Project Implementation Plan
-System Engineering Plan
-Risk Mitigation Plan
-Integrated Design Definition Documents (Constellation)
-Milestone Review Briefing Packages (SDR, PDR, CDR etc)
-Concept Study Report/Proposal (if applicable)
-Concept of Operations
-Integrated Master Schedule
-Integrated Test Plan
-Monthly Status Reports
-Any Instrument specific MDR, CDR, PDR packages
-ATLO Plan (used later in the project)
-Mission Readiness Review (used later in the project)
-Pre Environmental Readiness Review (used later in the project)
-Launch Readiness Review (used later in the project)

Part B. Technical Data
-Master Equipment Lists
-Project Schedules
-Mass Property Reports
-Power Budget Summary Report
-Software Design Reports
-Milestone Briefing Packages/Documentation

Part C. Life Cycle Cost Estimate
-Project Cost Estimate by WBS
-WBS Dictionary
-POP costing details
-533 reports (used later in the project)
-EVM reports (used later in the project)

What CADRe Does… and Does Not Do

CADRe Does

- Provide a detailed snapshot of the project at each milestone.
- Presents the known details of the project.
- Uses existing project documents.
- Captures technical programmatic, cost, schedule detail.
- Track and explain changes from previous milestone.
- Actually helps the PM record in a formal agency document events that occurred during the project (both internal & external).

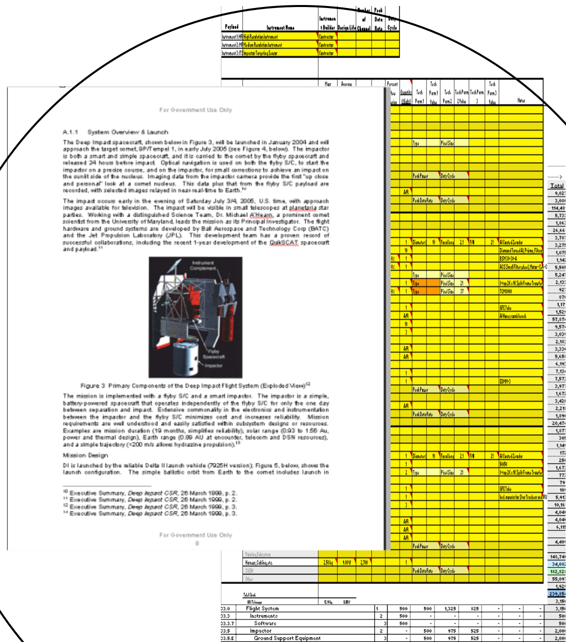
CADRe Does Not

- Operate as a project monitoring tool.
- Provide any evaluations, opinions, or recommendations of the project.
- Create another independent estimate of the project.
- Force the project to create new or additional documentation to support CADRe.
- Cause hardship on project time and resources.

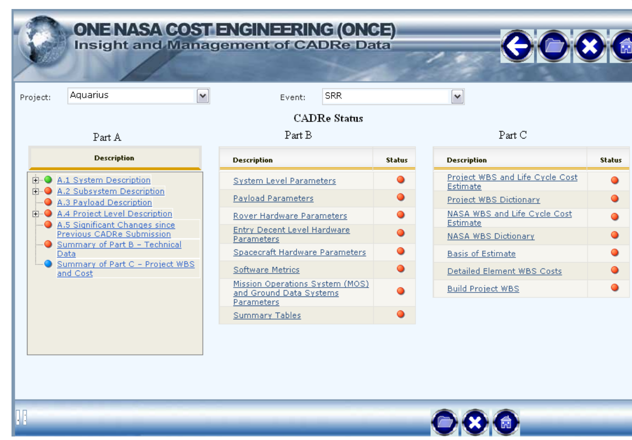
(PA&E/CAD pays for and coordinates all CADRes developed across NASA)

CADRes are being loaded into ONCE database

Completed CADRes



ONCE Database



ONCE Design Features

ONCE Database

- Web-based
- Controlled access
- Automated CADRe Search & Query

Mimics CADRe templates: Parts A, B and C

- Fast source document upload for developers
- Reporting features to quickly pull needed data

How do I Access CADRes?

- Developed CADRes to date are all contained on NSCKN. Go to link and apply for an account: https://nsckn.nasa.gov/
- For help contact Eric Plumer for access.
- Access Rules
  - HQ personnel will have access to all CADRe data
  - NASA center personnel will have access to
    - Only their own pre-launch CADRe data
    - All CADRes after missions have been launched

How do I Access ONCE database?

- Contact Eric Plumer for access.
- https://oncedata.com
- On login screen download access form
- Fill out form and email/fax to Eric Plumer
- Anyone with a valid NASA Identity in IDMAX can have access.

Points of Contact

- **NASA**

  Eric Plumer
  (202) 358-5178(O)
  202 420-0970 (M)
  eplumer@hq.nasa.gov